Types of Machine Learning Techniques

Supervised Learning

In supervised learning, the algorithm is trained on a dataset containing input-output pairs (labeled data). The goal is to learn a function that maps the input to the correct output by minimizing the error between predicted and actual values. After training, the model can make predictions on new, unseen data.

Regression

In regression, the output is a continuous value. The goal is to predict a numerical output based on input features.

Example

Predicting house prices based on size and location, forecasting sales figures over time.

Classification

In classification, the output is a discrete label or category. The goal is to assign an input to one of several predefined categories or classes.

Example

Email spam detection (spam or not spam), digit recognition (0–9), sentiment analysis (positive, neutral, negative).

Unsupervised Learning

In unsupervised learning, the algorithm is given data without explicit labels or categories. It must find hidden patterns, groupings, or structure within the data. Common tasks include clustering and dimensionality reduction.

Clustering

Clustering algorithms divide data into groups based on similarity. The number of clusters is usually not known in advance, and the algorithm must discover the structure in the data.

Example

Customer segmentation for marketing, grouping similar documents or images, detecting anomalies in network traffic.

Dimensionality Reduction

The goal is to reduce the number of input features while retaining as much information as possible. This helps in visualization, speeding up computation, and removing noise from data.

Example

Principal Component Analysis (PCA) for visualizing high-dimensional data, reducing features in a dataset for faster processing.

Association Rule Learning

This method discovers interesting relationships or associations between variables in large datasets.

Example

Market basket analysis in retail, where the algorithm might find that customers who buy bread often buy butter as well (i.e., bread → butter).

Reinforcement Learning

Reinforcement learning involves an agent that interacts with an environment and learns to take actions that maximize cumulative rewards. The agent receives feedback through rewards or penalties (reinforcement) based on its actions and learns to choose actions that lead to higher rewards over time.

Example

In a self-driving car simulation, the car (agent) learns to navigate roads (environment) by receiving rewards for following traffic rules and penalties for actions like crashing or speeding. The goal is to learn a policy that results in safe and efficient driving behavior over many trials.